ROCKY MOUNTAIN OILFIELD TESTING CENTER

PROJECT TEST RESULTS

AUTOMATIC SHUTDOWN VALVE
CAMBRIA VALVE CORPORATION

OCTOBER 17, 1995

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RMOTC TEST REPORT

Automatic Shutdown Valve
Cambria Valve Corporation

Prepared for:

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ABSTRACT

The Rocky Mountain Oilfield Testing Center (RMOTC) conducted a test of an Automatic Shutdown Valve (ASDV) for hydraulic systems at the Naval Petroleum Reserve No. 3 (NPR-3). The Cambria Valve Corporation (CVC) manufactures the 3-Port ASDV that is designed to automatically shut down the flow of fluid through a hydraulic system in the event of a ruptured line and safely redirect flow to a bypass system. The CVC ASDV effectively demonstrated its capabilities over the tested range.

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AUTOMATIC SHUTDOWN VALVE

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INTRODUCTION:

The Cambria Valve Corporation (CVC) 3-Port Automatic Shutdown Valve (ASDV) has the capability of automatically shutting down the flow of fluid through a hydraulic system in the event of a ruptured line, and it can redirect flow to a bypass/redundant system. The ASDV has applicability to all heavy equipment utilized in oilfield operations.

The valve is designed with three ports: inlet, outlet, and bypass. When a ruptured situation is sensed at the outlet, flow is blocked and immediately diverted to the bypass port. Other ASDVs only shut down the flow of hydraulic fluids. This abrupt termination of flow can result in overpressuring of the system and rupturing of other weak links in the system. The CVC ASDV eliminates overpressuring the system by diverting flow to a second outlet port.

The system was tested June 14, 1995 on CVC's truck mounted hydraulic test bed, which permitted various "normal" flow rates and pressures to be established and then "diverted" flow parameter measurements to be taken following simulated rupture of the system hydraulic line. As shown in Figure 1, the CVC ASDV will block "normal" flow through the port hosting the simulated rupture and automatically divert it to the bypass port.

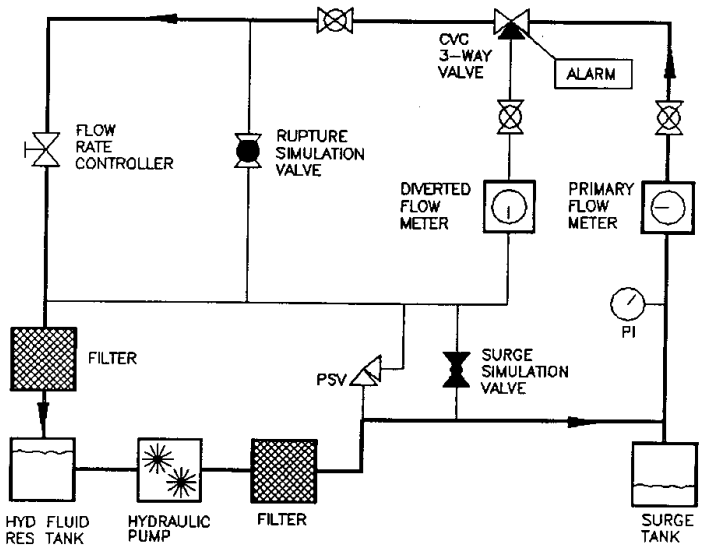
The test system also incorporated a visual alarm. In response to the simulated ruptures, the ASDV effectively annunciated the failures. The system could also be configured to shut down equipment or to sound audible alarms.

The CVC ASDV that was tested was a 3/4" 3-Port valve (part number 812-525) that was designed for approximately 35 gpm and 1,700 psi. These parameters are typical of small hydraulically operated machinery.

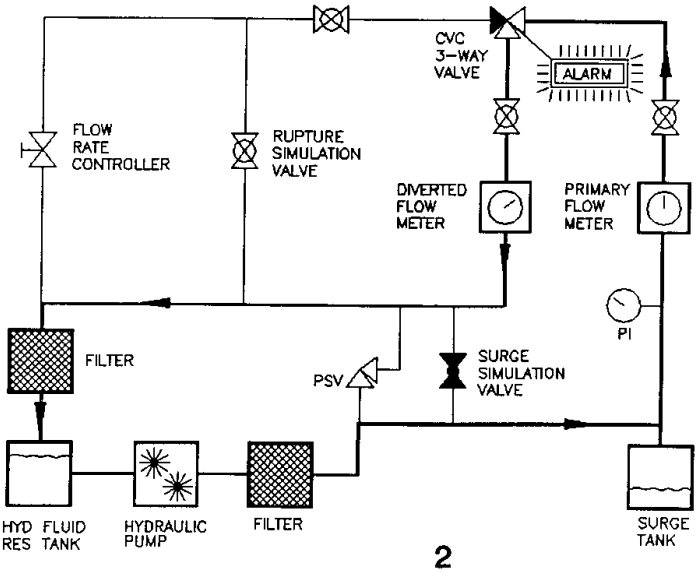
FIGURE 1

CAMBRIA VALVE CORPORATION
AUTOMATIC SHUTDOWN VALVE
TEST SETUP FLOW DIAGRAM

NORMAL FLOW



DIVERTED FLOW



TESTING DETAILS:

The test was designed to demonstrate that:

- The response time for the valve to shut down flow is less than 5 seconds;
- The valve reliably diverts flow without operational failure for a minimum of 12 consecutive tests; and
- The mechanical integrity of the valve is insensitive to variances in system flow rate and pressure.

Shutdown response-time testing was conducted by measuring the time between when the "rupture simulation valve" was opened and when the fluid was diverted. The results of the test are tabulated in Table 1. Notes: 1) Data could not be precisely correlated between flow meters because instruments were not calibrated. 2) Response times are not precise, because timers were "visually" synchronized with events.

After establishing the "lower nominal operating limit" (1,000 psi @ 20 gpm) for the acceptable 5 second response, 20 consecutive successful tests were run within the nominal ranges of 1,000 to 1,700 psi and 15 to 35 gpm. All 20 tests had response times of 3 seconds or less. The tests of higher flow rates and pressures shut down and diverted the hydraulic fluid in approximately 1 second.

Abrupt movement of equipment can produce hydraulic surges that will dramatically vary system flow rates and pressure, and the design of an ASDV needs to be forgiving of such surges. Surge testing was conducted on the test bed by abruptly varying the flow rate from 10 to 20 gpm using the "surge simulation valve". The surging had no effect on the performance of the ASDV for the tested conditions.

TABLE 1

CAMBRIA VALVE CORPORATION AUTOMATIC SHUTDOWN VALVE

TEST No.	ACTUAL PRESSURE (PSIG)	ACTUAL RATE (GPM)	RUPTURED RATE (GPM)	FLOW DIVERTED (GPM)	SHUTDOWN RESPONSE TIME (SEC)	COMMENTS
1	1010	25	42	42	3	
2	1020	30	48	44	1	
3	1020	33	49	45	1	
4	1030	25	42	42	2	
5	1060	33	50	46	2	
6	1200	30	50	46	1	
7	1220	34	52	47	1	
8	1440	20	50	43	1	SURGE TEST (10-20 GPM)
9	1500	19	49	44	2	
10	1500	30	55	48	1	
11	1500	32	55	48	1	
12	1520	23	53	46	1	
13	1540	14	45	42	2	
14	1540	22	52	50	2	
15	1600	22	53	46	1	SURGE TEST (10-20 GPM)
16	1640	30	60	50+	1	
17	1690	33	60	50+	1	
18	1740	14	55	48	1	
19	1740	21	56	48	1	
20	1740	22	60	50+	1	

CONCLUSIONS:

Testing of the CVC ASDV proved that the device can effectively divert fluids from ruptured hydraulic systems. The response time of the ASDV was less than 5 seconds for all tests above the "lower nominal operating limit", and it was immediate at higher flow rates and pressures. The reliability of the ASDV was demonstrated by the successful execution of 20 consecutive tests. Between tests, the valve was readily reset into operation without removing from service. The valve also demonstrated insensitivity to variances in system flow rate and-pressure during surge testing.

Several potential benefits of the CVC ASDV are readily apparent, including:

- Mitigated environmental damage due to minimization of hydraulic fluid spillage;
- Increased personnel safety due to immediate diversion of fluids; and
- Elimination of secondary ruptures from system overpressuring.

ACKNOWLEDGEMENTS:

This report was prepared by the Rocky Mountain Oilfield Testing Center (RMOTC) based on field testing conducted at the Naval Petroleum Reserve No. 3 (NPR-3), located 35 miles north of Casper in Natrona County, Wy., in cooperation with the U.S. Department of Energy. Testing was funded jointly by Cambria Valve Corporation of Casper, Wyoming and RMOTC. Work was directed by RMOTC Project Manager, Michael J. Taylor.

RMOTC is operated by Fluor Daniel (NPOSR), Inc., the Management and Operating Contractor for the DOE Naval Petroleum Oil Shale Reserves in Colorado, Utah and Wyoming. RMOTC's goal is to partner with the oil and gas industry to improve productivity by field testing new petroleum technology, evaluating new equipment and techniques, disseminating information to industry, and conducting training. For information contact the RMOTC, 907 North Poplar, Suite 100, Casper, Wy. 82601; phone 307-261-5000, ext. 5060.

For information about the Cambria Valve Corporation Automatic Shutdown Valve contact Richard J. Bratton; Cambria Valve Corporation, 135 N. Ash, Suite 200, Casper, Wyoming 82601; phone 307-234-7800 / fax 307-234-9847.